Amendments to the Specification

Please replace the paragraph beginning at page 8, line 1, with the following rewritten paragraph:

-- Engine 13 also comprises exhaust manifold 48 coupled to exhaust ports of the engine (not shown). Catalytic converter 52 is coupled to exhaust manifold 48. In the preferred embodiment, catalytic converter 52 is a multiple brick catalyst. Figure 9 illustrates an exemplary multiple brick catalyst having three bricks, 52A, 52B, and 52C. Oxygen sensors 902, 904, and 906, preferably being EGO, UEGO or HEGO sensors, are positioned respectively behind bricks 52A, 52B, and 52C. Referring again to Figure 1, a first conventional exhaust gas oxygen (EGO) sensor 54 is positioned upstream of catalytic converter 52 in exhaust manifold 48. A second conventional exhaust gas oxygen (EGO) sensor 53 is positioned downstream of catalytic converter 52 in exhaust ~~manifold 48~~ **path 49**. EGO sensors 53 and 54 may comprise other known oxygen or air/fuel ratio sensors, such as HEGO or UEGO sensors. Engine 13 further comprises intake manifold 56 coupled to throttle body 58 having throttle plate 60 therein. Intake manifold 56 is also coupled to vapor recovery system 70. --

Please replace the paragraph beginning on page 13, line 12, with the following rewritten paragraph:

-- Block 232 signifies an "oxidant level/capacity controller", which calculates engine control signals intended to cause the engine 13 to function so as to control the oxidant level in the catalyst 52 close to the oxidant set point, as well as to control the oxidant storage capacity of the catalyst 52. Specifically, the oxidant level/capacity controller (232) calculates an air/fuel control bias signal (238) that is used to

adjust the air/fuel ratio provided to the engine cylinders. The air/fuel control bias signal (238) is the primary mechanism of adjusting the oxidant level in the catalyst 52. The oxidant level/capacity controller (232) also calculates an air mass bias signal (236) and a delta spark signal (234). The air mass bias and delta spark signals are used to adjust the oxidant storage capacity of the catalyst 52 by controlling the temperature of the catalyst. The oxidant level/capacity controller (232) further calculates Reset/Adaptive Coefficients **241**, which essentially cause the oxidant level prediction algorithms to be reset or adjusted based on feedback signals. A more detailed description of the oxidant level/capacity controller (232) is provided below in connection with a discussion of Figure 7. --

Please replace the paragraph beginning on page 17, line 5, with the following rewritten paragraph:

-- Returning to Figure 3, block 302 signifies the start of the available oxidant storage estimator algorithm (226). Blocks 208 and 210 illustrate that the individual brick temperatures (208) and the catalyst deterioration factor (210) are dynamic inputs to the algorithm~~,~~ (226). The individual brick temperatures (208) are preferably measured with temperature sensors, and alternative preferred methods for determining the catalyst deterioration factor are described above. At block 310, the theoretical maximum oxidant storage capacity of a catalyst brick during normal operating temperature is calculated**, using adaptive inputs 240**. The maximum oxidant storage capacity, being a function of washcoat, is measured at a given temperature. This capacity is then multiplied by the deterioration factor to produce a theoretical maximum oxidant storage. --

Please replace the paragraph beginning on page 27, line 1, with the following rewritten paragraph:

-- The oxidant level estimator algorithm begins at block 602. At block 604, it is determined whether an oxidant state initialization is required, i.e., whether or not the vehicle has just been started. If the vehicle has just been started, then the oxidant estimator model must be initialized because oxidants tend to gradually fill the catalyst for a period after the vehicle has been turned off, then are released as the catalyst cools. An initialization of the oxidant estimator model involves determining the oxidant state of the catalyst 52 based on the "soak time" (time since the vehicle was turned off) and the current temperature of the catalyst **at block 606**. If the soak time is relatively long, then the current oxidant level of the catalyst 52 is determined to be a preset value corresponding to a "cold start" of the vehicle because it is assumed that the catalyst has filled with oxidant to a predictable level. On the other hand, if the soak time is relatively short, then catalyst 52 has likely not yet filled with oxidant to the same extent as during an extended soak. Therefore, the initial oxidant state of catalyst 52 is determined based on the last oxidant state (before the vehicle was turned off), the soak time, the current catalyst temperature, and an empirical time constant, as shown in block 610. --

Please replace the paragraph beginning on page 43, line 18, with the following rewritten paragraph:

-- The second objective of the oxidant level/capacity controller (232), i.e., oxidant capacity control of the catalyst 52, will now be discussed in more detail. Referring again to Figure 7, the following inputs are used to calculate delta spark and induction air mass bias values: (i) available oxidant storage

in each brick (227); (ii) current oxidant storage in each brick (231); (iii) engine spark driveability limits (216); exhaust flange temperature (220); and MBT spark (222). First, the estimates of available oxidant storage and current oxidant storage in each of the catalyst bricks are summed (blocks 710 and 711) **at block 701**, resulting in an estimate of the total available oxidant storage in the catalyst and an estimate of the total current amount of oxidants stored in the catalyst, respectively. Then, the total available oxidant storage value (710) is compared to the total current estimated oxidant storage in the catalyst (711) at block 713. At block 702, a spark retard value is calculated based on the difference between available oxidant storage and current oxidant storage in the catalyst (from block 713) and spark driveability limits (216). In the preferred embodiment of the invention, the spark retard value (702) is read from a look-up table, wherein the values are empirically determined. The spark retard values in the look-up table generally describe the well-known relationship between oxidant storage and brick temperature, as shown in the graph set forth in Figure 8A. The spark driveability limits, which are pre-determined inputs to the system, limit the magnitude of the spark retard (702) to ensure that vehicle driveability is not compromised. --

Please replace the paragraph beginning on page 45, line 17, with the following rewritten paragraph:

-- However, as spark retard increases, engine rpm will fall if not compensated by additional air mass flow through the engine. Accordingly, the delta spark value (728) is used with the MBT spark input value (222) at block 706 to calculate a required engine torque value, as is known in the art. At block 708, the induction air mass necessary to maintain the required torque is

calculated. In the preferred embodiment of the invention, the desired air mass flow is calculated by dividing the base air mass flow requirements of the engine by an adjustment factor, which is read from a look-up table. The adjustment factors in the look-up table range from 1, when at MBT, to some fractional value down to zero as spark retard increases. Thus, as spark retard increases, the desired air mass flow increases. This air mass value comprises the air mass bias value ~~(730)~~ **(709)**, which is used by the engine controller 15 to adjust the induction air mass in the engine 13. The adjustments to the engine spark and induction air mass adjust the temperature of the exhaust expelled from the engine and thus, ultimately, the temperature of the catalyst 52. Because the oxidant storage capacity of the catalyst 52 depends on its temperature, the engine controller 15 is able to adjust the oxidant storage capacity of the catalyst 52 by adjusting the engine spark and induction air mass flow. This aspect of the invention is particularly useful during certain vehicle operating conditions when the catalyst temperature may fall to a level that would otherwise limit the oxidant storage capacity of the catalytic converter 52 to an undesirable small amount. By controlling engine operating conditions to provide a desired catalyst temperature, a certain minimum amount of total oxidant storage capacity can be maintained so that it is possible to control the actual oxidant storage to a mid-region and prevent break-through of emissions on the lean and rich air/fuel sides. --